**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

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| Appl. No. | : | 10/782,727 |
| Applicant | : | Lindfors et al |
| Filed | : | February 18, 2004 |
| TC/A.U. | : | 1763 |
| Examiner | : | Rudy Zervigon |
| Title | : | SHOWERHEAD ASSEMBLY AND ALD METHODS |
| Docket No. | : | ASMMC.050CP1 |
| Customer No. | : | 20,995 |

**ON APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES**

**APPEAL BRIEF**

**Mail Stop Appeal Brief – Patents**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

The Appellant appeals the final rejection of Claims 1-43 in the above-captioned patent application. These claims were rejected in a Final Office Action dated August 28, 2006.

This Appeal Brief is being filed in accordance with the rules of 37 C.F.R. § 41.37 and includes a Claims Appendix, an Evidence Appendix, and a Related Proceedings Appendix.

## I. REAL PARTY IN INTEREST

The real party in interest is the assignee of record, ASM International N.V. of Bilthoven, 3723 BC, Netherlands.

## II. RELATED APPEALS AND INTERFERENCES

The Appellant knows of no other appeals or interferences that will directly affect, be directly affected by, or have a bearing on the Board's decision in this Appeal.

## III. STATUS OF CLAIMS

Claims 1-43, as listed the Claim Appendix, remain pending and are the subject of this Appeal.

Claims 44-64 were canceled in the Amendment dated June 9, 2006.

Of the pending claims, Claims 1-6, 8-9, 11-15, and 17-43 are original claims and Claims 7, 10 and 16 were amended in the Amendment filed on June 9, 2006.

On August 28, 2006, the Examiner finally rejected Claims 1-43 over various prior art references.

Claims 1-43 are the subject of this appeal.

## IV. STATUS OF AMENDMENTS

The Amendment to the Claims made on June 6, 2006 was entered. No claim amendments are pending in this case or have been filed subsequent to the final rejection.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

### A. Independent Claim 1

As recited in the Claim Appendix, Claim 1 reads as follows:

> An apparatus for depositing a thin film on a substrate, comprising:
> a reaction chamber having a reaction space;
> a substrate holder for holding the substrate within the reaction space;
> a gas outlet in fluid communication with the reaction space;
> a gas exchange plate having a first side and a second side, positioned within the reaction chamber, the plate comprising:
> a plurality of first passages machined therein being in fluid communication with a first reactant gas source and a purge gas source, the first passages communicating with a plurality of first apertures spaced along the first passages, the first apertures opening to the reaction space;
> a plurality of second passages machined therein being in fluid communication with a second reactant gas source and a purge gas source, the second passages communicating with a plurality of second apertures spaced along the second passages, the second apertures opening to the reaction space; and
> a plurality of third apertures extending from the first side to the second side of the gas exchange plate, allowing gas to pass therethrough.

With initial reference to the illustrated embodiment of Figure 1, independent Claim 1 recites an ALD reactor 100 for depositing a thin film on a substrate. The reactor 100 includes a reaction chamber 102, which defines a reaction space 142. *See* paragraph 34, lines 1-10 and paragraph 35 lines 6-8. A substrate support plate 114 is provided in the reaction space 142. *Id.* An exhaust conduit 174 is in fluid communication with the reaction space 142 through the gas exhaust space 119. Paragraph 40.

A gas exchange plate 116 is positioned within the reaction space 142. Paragraphs 34 and 37. With reference to Figures 3-5, the gas exchange plate 116 includes a plurality of machined gas flow passage networks. Paragraph 45, lines 1-3. Each network includes a main passage 148, 149 that communicates with a gas inlet 158, 159 and distribution passages 150, 154. Paragraph 50. Apertures 152, 156 are appropriately spaced along the distributor passages 150,

154 and allow gas to be guided out of the gas exchange plate 116 and onto the substrate under the gas exchange plate 116.

Also machined within the gas exchange plate 116 are a plurality of exhaust apertures 157. Paragraph 50. The exhaust apertures 157 extend from the first (passage) side 550 of the gas exchange plate 116 to the second (reaction space) side, allowing gas to travel from one side of the gas exchange plate 116 to the other.

**B. Independent Claim 26**

As recited in the Claim Appendix, Claim 26 reads as follows:

An apparatus for depositing a thin film on a substrate, comprising:
a reaction chamber having a reaction space;
a substrate support, disposed within the reaction space;
a first plate positioned above the substrate support, the first plate having:
a first gas inlet fluidly connected to a first plurality of apertures via a first gas pathway;
a second gas inlet fluidly connected to a second plurality of apertures via a second gas pathway, wherein the first and second pathways are machined into the first plate;
a third plurality of apertures allowing gas to pass through the first plate; and
a second plate fixed to a gas outlet, positioned above the first plate, having a plurality of apertures allowing gas existing between the first plate and the second plate to flow to the gas outlet.

With initial reference to the illustrated embodiment of Figure 1, independent Claim 1 recites an ALD reactor 100 for depositing a thin film on a substrate. The reactor 100 includes a reaction chamber 102, which defines a reaction space 142. *See* paragraph 34, lines 1-10 and paragraph 35 lines 6-8. A substrate support plate 114 is provided in the reaction space 142. *Id.* An exhaust conduit 174 is in fluid communication with the reaction space 142 through the gas exhaust space 119. Paragraph 40.

A gas exchange plate 116 is positioned within the reaction space 142. Paragraph 34 and 37. With reference to Figures 3-5, the gas exchange plate 116 includes a plurality of machined gas flow passage networks. Paragraph 45, lines 1-3. Each network includes a main passage 148, 149 that communicates

with a gas inlet 158, 159 and distribution passages 150, 154. Paragraph 50. Apertures 152, 156 are appropriately spaced along the distributor passages 150, 154 and allow gas to be guided out of the gas exchange plate 116 and onto the substrate under the gas exchange plate 116.

Also machined within the gas exchange plate 116 are a plurality of exhaust apertures 157. Paragraph 50. The exhaust apertures 157 extend from the first (passage) side 550 of the gas exchange plate 116 to the second (reaction space) side, allowing gas to travel from one side of the gas exchange plate 116 to the other. A gas exhaust plate 118 is positioned against the gas exchange plate 116 so that main passages 148, 149 and distributor passages 150, 154 (which are formed by surface grooves in the illustrated embodiment) are sealed against the gas exhaust plate 118 from the top side of the passages. *See* paragraph 39. Gases can exit the reaction space 142 through the exhaust apertures 157 of the gas exchange plate 116. *Id.*

## C. Independent Claims 27 and 34

27. A showerhead assembly for a vapor deposition chamber, comprising:

a gas exchange plate having a thickness between a first side and a second side, the gas exchange plate defining a first network of passages in fluid communication with a first gas inlet and a second network of passages in fluid communication with a second gas inlet, the first and second network of passages including a plurality of first and second apertures opening from the first and second network of passages, respectively, to the second side of the gas exchange plate, the first and second apertures being interspersed and spaced across the second side of the gas exchange plate, the gas exchange plate further including a plurality of third apertures extending from the first side to the second side through the thickness of the gas exchange plate and being isolated from the first and second network of passages; and

an exhaust plate having a plurality of exhaust apertures therein, the exhaust plate configured to mate with the gas exchange plate and align the exhaust apertures with the third apertures of the exhaust plate.

34. A showerhead plate having a first side and a second side, comprising:

a first flow path through the showerhead plate, the first flow path including a plurality of first apertures opening to the second side of the showerhead plate;

> a second flow path through the showerhead plate, the second flow path isolated from the first flow path within the plate, the second flow path including a plurality of second apertures opening to the second side of the showerhead plate; and a plurality of third apertures extending through the showerhead plate, the third apertures isolated from the first and second flow paths within the showerhead plate

As described above, a gas exchange plate 116 is positioned within the reaction space 142. Paragraph 34 and 37. With reference to Figures 3-5, the gas exchange plate 116 includes a plurality of machined gas flow passage networks. Paragraph 45, lines 1-3. Each network includes a main passage 148, 149 that communicates with a gas inlet 158, 159 and distribution passages 150, 154. Paragraph 50. Apertures 152, 156 are appropriately spaced along the distributor passages 150, 154 and allow gas to be guided out of the gas exchange plate 116 and onto the substrate under the gas exchange plate 116.

Also machined within the gas exchange plate 116 are a plurality of exhaust apertures 157. Paragraph 50. The exhaust apertures 157 extend from the first (passage) side 550 of the gas exchange plate 116 to the second (reaction space) side, allowing gas to travel from one side of the gas exchange plate 116 to the other. A gas exhaust plate 118 is positioned against the gas exchange plate 116 so that main passages 148, 149 and distributor passages 150, 154 (which are formed by surface grooves in the illustrated embodiment) are sealed against the gas exhaust plate 118 from the top side of the passages. *See* paragraph 39. Gases can exit the reaction space 142 through the exhaust apertures 157 of the gas exchange plate 116. *Id.*

## VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. The rejection of Claims 1-43 under 35 U.S.C. 112, first paragraph.

B. The rejection of Claims 1-9, 11, 13, 16, 18, 20, 21, 30-32, 34-36 and 39-42 under 35 U.S.C. 102(b) as anticipated by Heming (6,025,013).

C. The rejection of Claims 10, 12, 22-29, 33, 37, 38, and 43 under 35 U.S.C. 103(a) as being unpatentable over Heming in view of Oda (USPN 5,010,842).

D. The rejection of Claims 14 and 15 under 35 U.S.C. 103(a) as unpatentable over Heming in view of Kobayashi (USPN 5,370,709).

E. The rejection of Claims 17 and 19 under 35 U.S.C. 103(a) as unpatentable over Heming in view of Olgado (USPN 6,736,408).

## VII. ARGUMENT

### A. The rejection of Claims 1-43 under 35 U.S.C. 112, first paragraph.

During prosecution of the present application, the drawings have been objected to for not showing the following features recited in the claims: gas outlet, first apertures, first passages, second passages, second apertures, third apertures, first distributor passages, grooves, recess, wafer handler, first and second holes, first flow path, second flow path, first bore, and second bore. Claims 1-43 have also been rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement apparently for failing to the terms recited above in the specification.

To advance prosecution, in the Amendment dated June 9, 2006, Applicant amended the Specification to provide more explicit antecedent basis for the terms mentioned above. As has been noted, these terms were in the original claims and, therefore, no new matter was been added. Nevertheless, the Examiner continues to object to the drawings and to reject the claims under 35 U.S.C. 112, first paragraph. Applicant respectfully traverses this rejection.

At paragraph 13, the Final Office Action state "that Applicant has claimed a grand total of sixteen (16) claim elements that are not described in or supported by Applicant's original disclosure as filed." This is not correct. The claim elements noted above ***are in the original claims, which are part of the original disclosure as filed.*** Applicant respectfully notes M.P.E.P. 608.01(l) which states that the "applicant may rely not only on the description and drawing as filed but also on the **original claims**...." (emphasis added)

Section 608.01(l) also states that:

> Where subject matter not shown in the drawing or described in the description is claimed in the application as filed, and such original claim itself constitutes a clear disclosure of this subject matter, then the claim should be treated on its merits, and requirement made to amend the drawing and description to show this subject matter. **The claim should not be attacked either by objection or rejection because this subject matter is lacking in the drawing and description. It is the drawing and description that are defective, not the claim.** (emphasis added)

As noted above, in the previous Amendment, Applicant amended the Specification to provide antecedent basic in the Specification for the noted claim language. In addition, Applicant has noted that each of these claim limitations are already in the drawings. Thus, any defects in the drawings or specifications have been cured. Accordingly, Applicant has complied with the requirements of M.P.E.P. 608.01(l).

As noted above, Applicant respectfully submits that Applicant has merely used in the *original claims* words that do not ***exactly*** match those used in the specification and disclosure. Applicants submits that this common practice is permissible.

> The mere fact that a term or phrase used in the claim has no antecedent basis in the specification disclosure does not mean, necessarily, that the term or phrase is indefinite. There is no requirement that the words in the claim must match those used in the specification disclosure. Applicants are given a great deal of latitude in how they choose to define their invention so long as the terms and phrases used define the invention with a reasonable degree of clarity and precision. MPEP 2173.05(e)

For example, support for "gas outlet" can be found in paragraph 0040 which describes "an outlet 184 for expelling compressed gases from the pump" (i.e., a "gas outlet"). *See also* element 184 in FIG. 1. In a similar manner, (i) "first apertures" and "first passages" in fluid communication with a "first reactant source" and (ii) "second apertures" and "second passages" in fluid communication with a "second reactant source" are described in paragraph 037, which describes main passages 148,149 and in-feed apertures 152, 156 for the "A and B" precursors. "Third apertures" that extend "from the first side to the second side of the gas exchange plate" are also described in paragraph 037, which refers to "exhausts apertures 157". These components are all shown in Figure 1.

With respect to "first distributor passages" reference is made to paragraph 045, which references the "distributor passages 150, 154 branching off of the main passages 148, 149."

With reference to "grooves" and "recesses" reference is made to paragraph 039, which references "main passages 148, 149 and distributor passages 150, 154 (which

are formed by surface grooves in the illustrated embodiment) are sealed against the gas exhaust plate 118 from the top side of the passages."

With reference to "wafer handler", reference is made to paragraph 0036 and reference to the substrate support plate 114, which "can also be a wafer handler configured to move the wafer in and out of the reaction chamber in the direction indicated by the arrow 134."

With reference to "holes", reference is made to paragraph 0053, which describes "holes 508, 509 for attaching the gas inlets 158, 159 are drilled into the side of the gas exchange plate 116."

With reference to "first flow path" and "second flow path", reference is made to paragraph 0052, which describes "the gas flow paths defined by the passages 148, 149, 150, 154 and the in-feed apertures 152, 156."

With reference to "first bore" and "second bore" "extending from an edge of the plate", reference is made to paragraph 0053, which describes "holes 508, 509 for attaching the gas inlets 158, 159 are drilled into the side of the gas exchange plate 116." Although this paragraph may not provide specific antecedent basis for the terms, Applicant submits that these *original* claim terms are clearly supported by the Specification.

**B. The rejection of Claims 1-9, 11, 13, 16, 18, 20, 21, 30-32, 34-36 and 39-42 under 35 U.S.C. 102(b) as anticipated by Heming (6,025,013).**

Claims 1-9, 11, 13, 16, 18, 20, 21, 30-32, 34-36 and 39-42 stand rejected under 35 U.S.C. 102(b) as anticipated by Heming (USPN 6,025,013).

As has been discussed above, the present application discloses an improved apparatus for depositing a thin film on a substrate. As described in the specification, a gas exchange plate with apertures for the first reactant, the second reactant and the exhaust advantageously provides for the ability to exhaust through the same plane of the showerhead as the injection points of the reactants. This leads to more uniform application of gasses and is less subject to non-uniformities caused by downstream effects from reaction by-products. In addition, the present application discloses a novel

gas exchange plate 116 with passages and apertures for the first and second reactant and exhaust apertures that extend through the exchange plate. This elegant design allows for this gas flow pattern to be simply and cheaply manufactured. In addition, the gas exchange plate can be a replaceable part that does not require disassembly of the entire chamber.

With reference to the primary reference Hemming, this patent disclosures a schematic illustration (Figure 1) of a plasma CVD device. The device includes a gas section nozzle 10 with four presumably concentric sections 13, 14, 15, 16. See e.g., FIGS. 7a and 7b and the deformable cylinder 54 . The outer exhaust section 16 is positioned on the outside of the sections 13, 14, 15 for the feed gases. Thus, the structure disclosed by Hemming is entirely different than the structure disclosed in the present application. Specifically, instead of a exchange plate with passages formed therein, Hemming merely discloses a plurality of concentric cylinders which are capped by a plate 12 with holes. See e.g., FIGS. 7a and 7b and the deformable cylinder 54 . The outer exhaust section 16 is positioned on the outside of the sections 13, 14, 15 for the feed gases. Thus, Hemming merely discloses a plurality of concentric cylinders which are capped by a plate 12 with holes.

FIG. 1

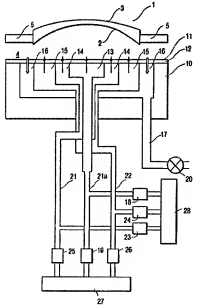



FIG. 7a

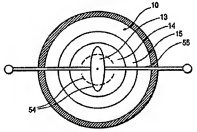
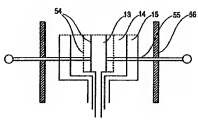



FIG. 7b



Claim 1 recites, in part, "a gas exchange plate" which includes "a plurality of first passages machined therein being in fluid communication with a first reactant gas source and a purge gas source, the first passages communicating with a plurality of first apertures spaced along the first passages, the first apertures opening to the reaction space; a plurality of second passages machined therein being in fluid communication with a second reactant gas source and a purge gas source, the second passages communicating with a plurality of second apertures spaced along the second passages, the second apertures opening to the reaction space; and a plurality of third apertures extending from the first side to the second side of the gas exchange plate, allowing gas to pass therethrough."

At paragraph 16, the final Office Action states that "'a plurality of centric cylinders which are capped by a plate 12 with holes' is not a feature that reads away from Applicant's claimed invention." Applicant disagrees. Hemming does not discloses a plate with a plurality of first and second passages machined therein and first and second apertures communicating with the first and second passages as recited in Claim 1. That is, the concentric cylinders are not a plate with machined first and second passages machined therein. The Final Office Action at page 5 cites Figure 1, structure 11-15 and column 11, lines 10-30 but there is simply no disclosure in these sections of Hemming of the plate with the machined passages as recited herein. Thus, Hemming can not anticipate Claim 1.

Claims 2-9, 11, 13, 16, 18, 20 and 21 depend upon Claim 1 and, for at least this reason, are also in condition for allowance.

Claims 30-32 depend upon independent Claim 27, which is discussed below, and for at least this reason are also in condition for allowance

Claim 34 recites in part a showerhead plate "having a first flow path through the showerhead plate, the first flow path including a plurality of first apertures opening to the second side of the showerhead plate; a second flow path through the showerhead plate, the second flow path **isolated** from the first flow path **within** the **plate**, the second flow path including a plurality of second apertures opening to the second side of the showerhead plate; and a plurality of third apertures extending through the

showerhead plate, the third apertures **isolated** from the first and second flow paths **within** the showerhead plate."

With respect to the limitation that the first and second flow paths are isolated from each other in within the plate, the Examiner again at page 11 simply cites to the gas nozzle structure 10 and 11 of Hemming. As noted above, Applicant submits that this does not meet the claim limitations of this claim.

As noted above, Hemming simply does not disclose this claimed structure. Accordingly, Claim 34 and dependent claims 36 and 39-42 are also in condition for allowance.

In general, Applicant respectfully submit that the Examiner is unreasonably disregarding several limitations in the claims and/or reading limitations so broadly that they simply have no meaning. As stated in M.P.E.P. 2111, "the pending claims must be given therein broadest reasonable interpretation **consistent** with the specification." (emphasis added). The broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach. *Id.*

Applicant respectfully submits that the Examiner is simply ignoring claim limitations such as "plate", "interspersed", "within", and "machined therein" and not giving them an interpretation that is reasonable and consistent with the specification.

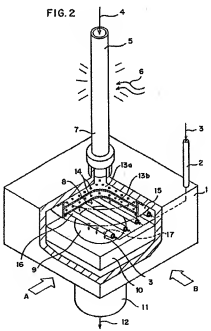
As discussed in the Application (see e.g., paragraphs 80-83 of the published application), in one preferred embodiment, the construction of the ALD reactor produces certain benefits. For example, the gas exchange plate and gas exhaust plate structures as claimed are simple and cheap to manufacture. They may be configured so that they are suitable as consumable items for after sales marketing. By providing a single plate with passages and apertures machined therein, the gas exchange plate is replaceable and is preferably cleaned or even discarded when deposition buildup results in less than optimal operation. Similarly, the gas exhaust plate structure is also replaceable. When deposition and other unwanted residue builds up in the gas exhaust plate apertures, the customer may replace the used gas exhaust plate with a cleaned one or a new one as well.

Additionally because the gas exchange plate is a replaceable part inside the reaction chamber, the customer can select an exchange plate structure that meets specific needs. For example, the size, the number and the location of the apertures can be optimized so that the whole wafer will be exposed uniformly to the reactant gas. Advantageously, the entire chamber does not require disassembly in order to replace the gas exchange plate; rather, the chamber can simply be opened and the gas exchange plate can be readily replaced with minimal reactor downtime and minimal re-tuning after replacement.

**C. The rejection of Claims 10, 12, 22-29, 33, 37, 38, and 43 under 35 U.S.C. 103(a) as being unpatentable over Heming in view of Oda (USPN 5,010,842).**

Heming has been discussed above. Oda, in turn, merely discloses a combination of pipes 20a. As with Hemming, Oda does not disclose, teach or suggest a gas exchange plate with passages and apertures for the first and second reactant and exhaust apertures that extend through the exchange plate. Accordingly, the gas distribution structure disclosed by Oda is noticeably more complicated than the structure disclosed in the present application. Moreover, the exhaust path in Oda is located below the pipes 20a.

FIG. 2



Accordingly, neither Hemming nor Oda, either alone or in combination, disclose or suggest plate with passages and apertures formed therein for the first and second reactant and separate exhaust apertures that extend through the exchange plate.

With respect to the rejected claims, Claim 26 recites in part, "a first plate a first plate positioned above the substrate support, the first plate having: a first gas inlet fluidly connected to a first plurality of apertures via a first gas pathway; a second gas inlet fluidly connected to a second plurality of apertures via a second gas pathway, wherein the first and second pathways are machined into the first plate; a third plurality of apertures allowing gas to pass through the first plate." Claim 26 also recites "a second plate fixed to a gas outlet, positioned above the first plate, having a plurality of apertures allowing gas existing between the first plate and the second plate to flow to the gas outlet."

At page 16, the Final Office Action states that Hemming discloses the above noted features. However, again, Applicant respectfully submits that neither Hemming nor Oda discloses a first plate with first and second passages machined therein. Hemming and Oda also do not disclose "a second plate positioned above the first plate having a plurality of apertures along gas existing between the first and second plate to flow to the gas outlet." The Examiner identifies structure 10 in Hemming which is identified as a gas section nozzle and is not a plate as recited in Claim 26.

Also rejected as obvious over Hemming in view of Oda is independent Claim 27, which recites, in part, "a gas exchange plate having a thickness between a first side and a second side, the gas exchange plate defining a first network of passages in fluid communication with a first gas inlet and a second network of passages in fluid communication with a second gas inlet, the first and second network of passages including a plurality of first and second apertures opening from the first and second network of passages, respectively, to the second side of the gas exchange plate, the first and second apertures being interspersed and spaced across the second side of the gas exchange plate, the gas exchange plate further including a plurality of third apertures extending from the first side to the second side through the thickness of the gas exchange plate and being isolated from the first and second network of passages."

With respect to the limitation that the first and second apertures are "interspersed", the Final Office Action cites at page 17 to top of 15, Figure 1 and column 11, lines 10-30 of Oda. However, Applicant does not find any disclosure or suggestion of interspersing apertures that are in communication with different networks of passages as recited in this claim. Thus, the Final Office Action has not provided a prima facie case of obviousness by identifying a combination of references that disclose, teach or suggest all of the limitations of the clams.

Claims 28-29 and 33 depend upon Claim 27 and, for at least this reason, are also in condition for allowance.

Claims 10, 12 and 22-25 depend upon allowable Claim 1 discussed above in Section A. As discussed in this section, Oda merely discloses a series of pipes and thus does not address the deficiencies noted in Heming with respect to the plates.

In a similar manner, Claims 37, 38, and 43 depend upon Claim 34 discussed above and, for at least, this reason, are also in condition for allowance.

**D. The rejection of Claims 14 and 15 under 35 U.S.C. 103(a) as unpatentable over Heming in view of Kobayashi (USPN 5,370,709).**

As noted above, Applicant respectfully submits that the Heming does not anticipate Claim 1 from which Claims 14 and 15 depend. Kobayashi is cited for the teaching of a heated susceptor plate and holding a substrate through the Bernoulli principle. Even assuming the characterization of these references is correct in the Final Office Action, this reference does not address the deficiencies in Heming noted above with respect to independent Claim 1. Accordingly, the cited combination does not establish a *prima facie* case of obviousness because it does not disclose all of the claim limitations.

**E. The rejection of Claims 17 and 19 under 35 U.S.C. 103(a) as unpatentable over Heming in view of Olgado (USPN 6,736,408).**

As noted above, Applicant respectfully submits that the Heming does not anticipate Claim 1 from which Claims 17 and 19 depend. Olgado is cited for the teaching of a vacuum chuck or a venturi in communication with the gas outlet. Even

assuming the characterization of these references is correct in the Final Office Action, this reference does not address the deficiencies in Heming noted above with respect to independent Claim 1. Accordingly, the cited combination does not establish a *prima facie* case of obviousness because it does not disclose all of the claim limitations.

**F. Conclusion**

In view of the foregoing arguments distinguishing Claims 1-43 over the art of record, Appellant respectfully requests that the rejection of these claims be reversed.

Please charge any additional fees, including any fees for additional extensions of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 4-30-07

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## CLAIMS APPENDIX

1. (**Original**) An apparatus for depositing a thin film on a substrate, comprising:

a reaction chamber having a reaction space;

a substrate holder for holding the substrate within the reaction space;

a gas outlet in fluid communication with the reaction space;

a gas exchange plate having a first side and a second side, positioned within the reaction chamber, the plate comprising:

a plurality of first passages machined therein being in fluid communication with a first reactant gas source and a purge gas source, the first passages communicating with a plurality of first apertures spaced along the first passages, the first apertures opening to the reaction space;

a plurality of second passages machined therein being in fluid communication with a second reactant gas source and a purge gas source, the second passages communicating with a plurality of second apertures spaced along the second passages, the second apertures opening to the reaction space; and

a plurality of third apertures extending from the first side to the second side of the gas exchange plate, allowing gas to pass therethrough.

2. (**Original**) The apparatus of Claim 1, wherein:

the first passages include a first main passage connected to a plurality of first distributor passages; and

the second passages include a second main passage connected to a plurality of second distributor passages.

3. (**Original**) The apparatus of Claim 2, wherein the first main passage is formed along a first side of the gas exchange plate and the second main passage extends parallel to the first main passage along an opposite side of the gas exchange plate.

4. (**Original**) The apparatus of Claim 3, wherein the first distributor passages extend parallel to the second distributor passages and extend perpendicularly from the first and second main passages, respectively.

5. (**Original**) The apparatus of Claim 4, wherein the first distributor passages alternate with the second distributor passages along an axis parallel to the first and second main passages.

6. (**Previously presented**) The apparatus of Claim 1, further comprising an exhaust plate having a first side and a second side, the second side of the exhaust plate being flush with the first side of the gas exchange plate.

7. (**Previously presented**) The apparatus of Claim 6, wherein the gas exhaust plate includes a plurality of exhaust apertures aligned with the plurality of third apertures of the gas exchange plate.

8. (**Original**) The apparatus of Claim 7, wherein the first and second passages comprise grooves on the first side of the gas exchange plate, the exhaust plate overlying and sealing the grooves to enclose the first and second passages.

9. (**Original**) The apparatus of Claim 7, wherein the exhaust plate includes a recess defined in the first side of the exhaust plate and an exhaust conduit communicating from the recess to an edge of the exhaust plate.

10. (**Previously presented**) The apparatus of Claim 9, further comprising a top plate having a first side and a second side, the second side of the top plate fitting with and sealing against the first side of the exhaust plate, thereby sealing and defining an exhaust space within the recess of the exhaust plate.

11. (**Original**) The apparatus of Claim 1, wherein the first, second and third apertures are interspersed with one another and substantially uniformly distributed across the gas exchange plate to provide gas flow substantially uniformly across the substrate holder.

12. (**Original**) The apparatus of Claim 1, wherein the first plurality of apertures are distributed along a plurality of parallel lines and the second plurality of apertures are distributed across a plurality of parallel lines alternated with the parallel lines of the first plurality of apertures.

13. (**Original**) The apparatus of Claim 1, wherein the substrate holder is an end effector of a wafer handler.

14. (**Original**) The apparatus of Claim 1, wherein the substrate holder is a platform comprising a heated susceptor plate.

15. (**Original**) The apparatus of Claim 1, wherein the substrate holder holds the substrate in place by operation of the Bernoulli principle.

16. (**Previously presented**) The apparatus of Claim 1, wherein the gas exchange plate is positioned below the substrate holder.

17. (**Original**) The apparatus of Claim 16, wherein the substrate holder is a vacuum chuck.

18. (**Original**) The apparatus in Claim 1, wherein the gas outlet is fluidly connected to a vacuum.

19. (**Original**) The apparatus in Claim 1, wherein the gas outlet communicates with a venturi.

20. (**Original**) The apparatus of Claim 1, further comprising controls for alternately providing first reactant to the first plurality of passages while stopping second reactant flow to the second plurality of passages and providing second reactant to the second plurality of passages while stopping first reactant flow to the first plurality of passages.

21. (**Original**) The apparatus of Claim 1, wherein the first and second plurality of passages comprise open grooves on the first side of the gas exchange plate.

22. (**Original**) The apparatus of Claim 21, wherein the grooves comprise rounded bottoms.

23. (**Original**) The apparatus of Claim 21, further comprising first and second holes through an edge of the gas exchange plate, the first and second holes communicating with the grooves of the first and second passages, respectively.

24. (**Original**) The apparatus of Claim 1, wherein the first and second apertures further comprise countersinks widening the first and second apertures at the second side of the gas exchange plate.

25. (**Original**) The apparatus of Claim 24, further comprising countersinks widening the third apertures at the second side of the gas exchange plate.

26. (**Original**) An apparatus for depositing a thin film on a substrate, comprising:

a reaction chamber having a reaction space;

a substrate support, disposed within the reaction space;

a first plate positioned above the substrate support, the first plate having:

a first gas inlet fluidly connected to a first plurality of apertures via a first gas pathway;

a second gas inlet fluidly connected to a second plurality of apertures via a second gas pathway, wherein the first and second pathways are machined into the first plate;

a third plurality of apertures allowing gas to pass through the first plate; and

a second plate fixed to a gas outlet, positioned above the first plate, having a plurality of apertures allowing gas existing between the first plate and the second plate to flow to the gas outlet.

27. (**Original**) A showerhead assembly for a vapor deposition chamber, comprising:

a gas exchange plate having a thickness between a first side and a second side, the gas exchange plate defining a first network of passages in fluid communication with a first gas inlet and a second network of passages in fluid communication with a second gas inlet, the first and second network of passages including a plurality of first and second apertures opening from the first and second network of passages, respectively, to the second side of the gas exchange plate, the first and second apertures being interspersed and spaced across the second side of the gas exchange plate, the gas exchange plate further including a plurality of third apertures extending from the first side to the second side through the thickness of the gas exchange plate and being isolated from the first and second network of passages; and

an exhaust plate having a plurality of exhaust apertures therein, the exhaust plate configured to mate with the gas exchange plate and align the exhaust apertures with the third apertures of the exhaust plate.

28. (**Original**) The showerhead assembly of Claim 27, wherein the first and second networks of passages comprise grooves formed in the first side of the gas exchange plate.

29. (**Original**) The showerhead assembly of Claim 28, wherein the first and second gas inlets comprise holes machined into an edge of the gas exchange plate and in fluid communication with the first and second network of passages, respectively.

30. (**Original**) The showerhead assembly of Claim 28, wherein the exhaust plate has a first side and a second side, the second side of the exhaust plate configured to seal the surface grooves of the first and second network of passages of the gas exchange plate when the second side of the exhaust plate is mated with the first side of the gas exchange plate.

31. (**Original**) The showerhead assembly of Claim 30, wherein the exhaust plate further comprises a recess formed in the first side of the exhaust plate, the recess being in communication with each of the exhaust apertures at a bottom of the recess.

32. (**Original**) The showerhead assembly of Claim 31, wherein the exhaust plate further comprises outlet conduits extending in fluid communication between the recess and an edge of the exhaust plate.

33. (**Original**) The showerhead assembly of Claim 32, further comprising a top plate having a thickness between a first side and a second side, the second side of the top plate configured to mate with and seal against the first side of the exhaust plate, thereby forming an exhaust space within the recess of the exhaust plate.

34. (**Original**) A showerhead plate having a first side and a second side, comprising:

a first flow path through the showerhead plate, the first flow path including a plurality of first apertures opening to the second side of the showerhead plate;

a second flow path through the showerhead plate, the second flow path isolated from the first flow path within the plate, the second flow path including a plurality of second apertures opening to the second side of the showerhead plate; and

a plurality of third apertures extending through the showerhead plate, the third apertures isolated from the first and second flow paths within the showerhead plate.

35. (**Original**) The showerhead plate of Claim 34, wherein the first and second apertures are interspersed and distributed across the second side of the showerhead plate.

36. (**Original**) The showerhead plate of Claim 35, wherein the first and second flow paths each include a main passage and a plurality of distributor passages branching from the main passage.

37. (**Original**) The showerhead plate of Claim 35, wherein the first and second flow paths each include a plurality of connected surface grooves.

38. (**Original**) The showerhead plate of Claim 37, wherein each of the surface grooves includes a rounded groove bottom.

39. (**Original**) The showerhead plate of Claim 37, wherein the first flow path includes a first main passage and a plurality of branching first distributor passages and the second flow path includes a second main passage and a plurality of branching second distributor passages.

40. (**Original**) The showerhead plate of Claim 39, further comprising a first bore extending from an edge of the plate into fluid communication with the first main passage and a second bore extending from an edge of the plate into fluid communication with the second main passage.

41. (**Original**) The showerhead plate of Claim 39, wherein the first and second main passages extend parallel to one another proximate opposite ends of the plate.

42. (**Original**) The showerhead plate of Claim 41, wherein the first and second distributor passages extend parallel to one another and perpendicular to the first and second main passages, the first and second

distributor passages alternating with one another along an axis of the main passages.

43. (**Original**) The showerhead plate of Claim 34, wherein each of the apertures includes a countersink.

44.-69. (**Cancelled**)

## EVIDENCE APPENDIX

[NONE]

## RELATED PROCEEDINGS APPENDIX

[NONE]

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